5.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

5.0.0.0.1 Section 4.0 presented individual analyses of each of the alternatives with respect to the three broad criteria: effectiveness, implementability, and cost. Per CEHNC Removal Action Planning guidance (CEHNC, 1995), once the alternatives have been described and individually assessed against the criteria without consideration of the other alternatives, a comparative analysis is conducted to evaluate the relative performance of each alternative in relation to each specific evaluation criterion.

5.0.0.0.2 Section 5.0 provides a comparative analysis of the removal action alternatives retained for Sectors 1 through 4. Only the alternatives passing the initial screening in Section 4.0 are considered for evaluation in this section (Table 4-20). The purpose of this comparative analysis is to identify the advantages and disadvantages of each retained alternative relative to one another so that the key tradeoffs can be identified.

5.0.0.0.3 To varying degrees, all of the alternatives are implementable. This EE/CA uses presumptive remedies that have been successfully implemented at other areas of former Camp Elliott (i.e., Tierrasanta and Mission Trails Regional Park) and other similar UXO sites. As discussed in Section 4.2.2, limiting factors that contribute to implementability include the time to implement an alternative (including logistical considerations associated with a large number of personnel) and the impact to endangered and threatened species that exist in each sector.

5.0.0.0.4 Based on the individual analyses of the alternatives presented in Section 4.3, the criteria which are most critical in identifying a proposed alternative are effectiveness and cost. A "cost-benefit" analysis is included in this section to further elaborate on the cost-effectiveness relationship.

5.0.0.0.5 Institutional Controls (Alternative 2) would not reduce the quantity of UXO that may be present within an area of concern, and therefore does not meet the USEPA's preference for treatment of wastes. However, this alternative may provide a cost-effective response which

strikes a balance between the need for protection of public health and the environment, and the availability of funds, which is also mandated by CERCLA. The clearance alternatives would not completely eliminate the potential exposure risk from the site. To minimize risk from residual UXO at the site, Institutional Controls may be combined with the clearance alternatives to provide continued protection of human health and safety. Surface Clearance (Alternative 3), Surface and Subsurface Clearance to a Depth of 1 Foot (Alternative 4), and Construction Support (Alternative 5) would directly reduce the quantity of OE present at East Elliott and could be conducted in such a manner as to comply with location- and action-specific ARARs that are within the scope of the removal action (see Section 3.4). No chemical-specific ARARs have been identified for East Elliott provided OE is not removed from the site.

5.0.0.0.6 Using the current risk of exposure as the baseline, the level of additional protection achieved by each alternative varies significantly. However, it must be stressed that there have been no documented accidents involving UXO (i.e., detonations that resulted in injury or death) at East Elliott. No Action (Alternative 1) has no impact on the potential risk of an encounter with UXO. Each alternative is progressively more effective at reducing risk, with the greatest reduction in risk occurring between Institutional Controls, which is expected to modify people's behavior if UXO is encountered, and Surface Clearance, which primarily consists of removal of OE from the ground surface.

5.1 ALTERNATIVES EVALUATION FOR SECTOR 1

5.1.0.0.1 Sector 1 is approximately 750 acres in the northwest quadrant of East Elliott and encompasses the area that would be occupied by the proposed City of San Diego landfill. The sector is bounded by Oak Canyon to the west and includes Spring Canyon along the eastern perimeter. The topography includes steep canyons, narrow ridges; and landslides. Vegetation is mixed chaparral and grass, with local expanses of dense brush in the southern and western portions of the sector. Roads are constructed along ridges.

5.1.0.0.2 All of the clearance alternatives (Alternatives 3, 4, and 5) were retained for Sector 1. The Institutional Controls alternative was also retained because these technologies may modify the behavior of people who encounter UXO, resulting in an overall reduction of the associated hazard. In addition, the No Action alternative was retained for baseline comparison. Thus, this comparative analysis includes the following alternatives:

- Alternative 1: No Action
- Alternative 2: Institutional Controls (Warning Signs and Display Boards)
- Alternative 3: Surface Clearance
- Alternative 4: Surface and Subsurface Clearance to a Depth of 1 Foot
- Alternative 5: Construction Support

5.1.1 Effectiveness

5.1.1.0.1 **Protection of Human Health and the Environment.** The primary basis for evaluating this criterion is the net reduction in UXO exposures provided by each alternative. As suggested in the risk analysis, a direct relationship exists between the quantity of UXO and potential for exposure to UXO. The No Action alternative does not reduce the amount of UXO, nor does it reduce the number of anticipated exposures to UXO, so this alternative is not protective of human health and the environment. Because fencing is not a viable option for Sector 1, Institutional Controls would not reduce the potential for exposure through access restriction. However, Institutional Controls would raise the public awareness about the possibility of UXO in the area. As discussed in Section 4.0, public awareness programs, including warning signs and display boards, have a net positive effect in reducing the exposure potential (approximately 20 to 25 percent).

5.1.1.0.2 Surface Clearance, Surface and Subsurface Clearance to a Depth of 1 Foot, and Construction Support would remove UXO from the surface where the majority of UXO was encountered (Appendix B). Surface and Subsurface Clearance to a Depth of 1 Foot would additionally protect human health and safety for ORV users and construction workers by removing UXO present in subsurface soils to a depth of 1 foot bgs. Construction Support would require UXO removal to depths of up to 3 feet bgs (the maximum depth of OE encountered) and

would be further protective of human health during construction work anticipated in the sector. However, risks to recreational users would remain until construction was complete.

5.1.1.0.3 Compliance with ARARs. Probably the most crucial ARAR associated with a removal action implementation at East Elliott is the impact to sensitive biological resources within the sector. The No Action alternative would have the least impact with regard to threatened and endangered species. Institutional Controls would require minimum brush pruning for installation of warning signs and display boards and should not result in measurable impact to sensitive biological resources in the area. Surface Clearance would entail more extensive brush thinning (15 percent) and would have a significant impact on the natural wildlife in the area. Brush thinning may temporarily reduce the mass of coastal sage scrub, which provides valuable habitat for the California gnatcatcher, a federal threatened and California species of special concern. The coastal sage scrub habitat in which the California gnatcatcher resides is regarded as one of the rarest and most endangered habitats in California. Surface and Subsurface Clearance to a Depth of 1 Foot and Construction Support also require excavations and would have the biggest impact on the endangered and threatened species. However, consultation with a biologist prior to and during clearance activities would help to minimize adverse ecological impacts of the removal action.

5.1.1.0.4 Long-Term Effectiveness. No Action and Institutional Controls do nothing to remove UXO from the area, and the latter would limit the land use in the long term because UXO would continue to pose a threat to human health and safety. Surface Clearance, Surface and Subsurface Clearance to a Depth of 1 Foot, and Construction Support would remove UXO from the surface and thus facilitate future land use. These clearance activities would also minimize any long-term threats associated with UXO. Because Surface and Subsurface Clearance to a Depth of 1 Foot and Construction Support would also facilitate removal of UXO from the subsurface, these alternatives would allow activities that may cause subsurface intrusion, such as landfill construction. However, risks to recreational users would remain for more than 50 years, so the long-term effectiveness of Construction Support is less than that of the other removal action alternatives.

5.1.1.0.5 Short-Term Effectiveness. Institutional Controls can be implemented relatively quickly. Therefore, the risk reduction could be achieved within a few months. Conversely, Surface Clearance (Alternative 3) and Surface and Subsurface Clearance to a Depth of 1 Foot (Alternative 4) would most likely require 5 years or more to complete. Therefore, these alternatives would have little short-term effectiveness. Because Construction Support is implemented in coordination with the landfill expansion, completion of the removal action within the entire sector would likely require more than 50 years. Therefore, Construction Support has no short-term effectiveness.

5.1.2 Implementability

5.1.2.0.1 Technical Feasibility. From a technical perspective, all alternatives are considered feasible. The technology to construct the warning signs and display boards is readily available and reliable, as is the geophysical equipment for detection of OE at the site. All alternatives have been successfully implemented at the former Camp Elliott (i.e., Tierrasanta and Mission Trails) in the past. Construction Support was recently provided to the Sycamore Landfill in East Elliott.

5.1.2.0.2 Administrative Feasibility. It is not likely that there would be any permits associated with implementation of Institutional Controls nor extensive subcontractor services such as security that would require oversight and coordination. However, easements or other agreements with property owners may be required. Institutional Controls would also require indefinite maintenance. Permitting requirements may be associated with Surface Clearance, Surface and Subsurface Clearance to a Depth of 1 Foot, and Construction Support during UXO detonation but are not expected to be extensive. These removal action alternatives would take longer to implement than Institutional Controls (i.e., years compared to months) and would require project oversight for an extended duration. This is particularly true for Construction Support.

5.1.2.0.3 Availability of Services and Materials. All services and materials required to implement the alternatives are readily and commercially available.

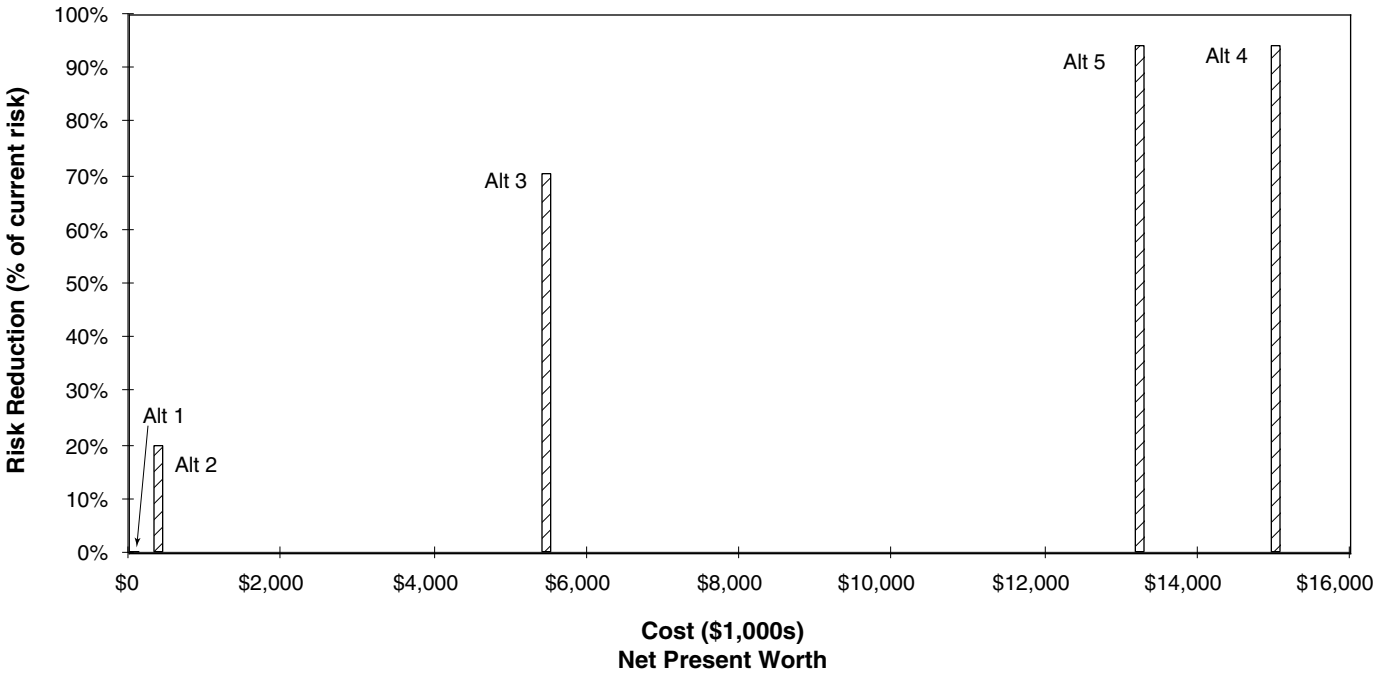
5.1.3 Cost

5.1.3.0.1 As described in Section 4.0, estimated costs for the alternatives are based on a 30-year present worth analysis of estimated direct initial costs, indirect initial costs, and recurring costs. There is uncertainty associated with the number of subsurface magnetic anomalies within Sector 1 and whether the anomalies require remediation. Therefore, a large project contingency (25 percent of initial and recurring costs) is included in the cost estimates. Itemized costs for each alternative retained for Sector 1 are presented in Appendices D (Alternative 2) and E (Alternatives 3, 4, and 5).

5.1.3.0.2 In general, both the initial and total costs are directly related to the degree of protection offered by an alternative. The greater the degree of protection, the higher the cost to implement an alternative. The alternatives can be ranked by increasing cost as follows: No Action, Institutional Controls, Surface Clearance, Construction Support, and Surface and Subsurface Clearance to a Depth of 1 Foot. Costs associated with Construction Support may increase due to the time required for implementation and completion of clearance activities. No costs would be incurred with the No Action alternative.

5.1.4 Cost-Benefit Analysis

5.1.4.0.1 Because each removal action alternative is generally implementable to varying degrees, the critical criteria for comparing the alternatives are effectiveness and cost. The relationship between cost and effectiveness, or relative risk reduction, can be illustrated by the Cost-Effectiveness graph on Figure 5-1. From the graph it is apparent that, in general, as an increased degree of protection is gained, greater financial costs are incurred.



Alt 1 – No Action
Alt 2 – Institutional Controls
Alt 3 – Surface Clearance
Alt 4 – Surface and Subsurface Clearance to a Depth of 1 Foot
Alt 5 – Construction Support

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FORMER CAMP ELLIOTT (EAST ELLIOTT)
COST-EFFECTIVENESS GRAPH FOR SECTOR 1

FIGURE 5-1

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5.1.4.0.2 Figure 5-1 suggests that a significant risk reduction for recreational users occurs between Institutional Controls and Surface Clearance. However, Surface and Subsurface Clearance to a Depth of 1 Foot and Construction Support do add 23 percent to risk reduction even though substantial additional costs are associated with these alternatives. This risk reduction is applicable to ORV users and construction workers. When considering only the current land use, these alternatives provide an additional risk reduction for recreational users of 8 percent. As evident from previous sampling results (Appendix B), approximately 40 percent of OE was found on the ground surface and the only UXO item found in Sector 1 was also on the ground surface. Surface Clearance represents the point beyond which the additional costs far outweigh the benefits.

5.1.4.0.3 Future land use scenarios include construction of a landfill in Sector 1. The completed landfill is expected to occupy most of the sector. Construction of a landfill would require deep excavations including surface and subsurface OE clearance to approximately 1 foot bgs to protect construction workers. More extensive removal actions at Sector 1 could be implemented in conjunction with the landfill construction. However, Surface Clearance before construction would significantly reduce an immediate threat to human health and safety for recreational users.

5.1.4.0.4 Beyond Surface Clearance, an additional 8 to 23 percent risk reduction would be realized with a substantial increase in costs. The additional cost is not justified when compared to risk reduction, making Surface and Subsurface Clearance to a Depth of 1 Foot and Construction Support economically prohibitive. However, some form of construction support may still be required during landfill construction, especially for subsurface clearance of UXO in the area to be excavated. Surface Clearance could be implemented before construction, with limited Construction Support during construction. This would serve to significantly reduce an immediate threat to human health and safety while providing for protection of construction workers in the future. Some additional costs would be associated with implementing the removal action in two phases, including separate mobilization/demobilization costs and the facilities setup

and maintenance costs. However, because no firm plans exist for landfill construction, subsurface clearance at this time is not the most cost-effective approach for Sector 1.

5.2 ALTERNATIVES EVALUATION FOR SECTOR 2

5.2.0.0.1 Sector 2 is approximately 650 acres in the northern central portion of East Elliott and encompasses the area that will eventually be occupied by the existing Sycamore Landfill (currently 170 acres, including the recent expansion). Little Sycamore Canyon is oriented north-south in the center of the sector. The predominant slope of the terrain is greater than 30 degrees. Vegetation is grasslands and mixed chaparral. Roads are constructed along ridges and within Little Sycamore Canyon.

5.2.0.0.2 All of the clearance alternatives (Alternatives 3, 4, and 5) were retained for Sector 2. The Institutional Controls alternative was also retained because these technologies may modify the behavior of people who encounter UXO for an overall reduction of the hazard associated with the presence of UXO. In addition, the No Action alternative was retained for baseline comparison. Thus, this comparative analysis includes the following alternatives:

- Alternative 1: No Action
- Alternative 2: Institutional Controls (Warning Signs, Display Boards, and Public Awareness Training)
- Alternative 3: Surface Clearance
- Alternative 4: Surface and Subsurface Clearance to a Depth of 1 Foot
- Alternative 5: Construction Support

5.2.1 Effectiveness

5.2.1.0.1 Protection of Human Health and the Environment. The primary basis for evaluating this criterion is the net reduction in UXO provided by each alternative. As suggested in the risk analysis, a direct relationship exists between the quantity of UXO and potential for

exposure to UXO. The No Action alternative does not reduce the amount of UXO, nor does it reduce the number of anticipated exposures to UXO, so this alternative is not protective of human health and the environment. Because fencing is not a viable option for Sector 2, Institutional Controls would not reduce the potential for exposure through access restriction. However, Institutional Controls would raise the public awareness about the possibility of UXO in the area. As discussed in Section 4.0, public awareness programs, including warning signs and display boards, have a net positive effect in reducing the exposure potential. Surface Clearance, Surface and Subsurface Clearance to a Depth of 1 Foot, and Construction Support would remove UXO from the surface, where the majority of the OE (67 percent) was encountered (Section 4.0). Surface and Subsurface Clearance to a Depth of 1 Foot would provide additional protection of human health and safety by removing UXO from subsurface soils to 1 foot bgs. Construction Support would include UXO clearance to depths of up to 3 feet and would protect construction workers during the landfill expansion. However, risks to recreational users would remain until construction was complete (50 to 100 years).

5.2.1.0.2 Compliance with ARARs. Probably the most crucial ARAR associated with a removal action implementation at East Elliott is the impact to sensitive biological resources that exist within the sector. The No Action alternative would have the least impact with regard to threatened and endangered species. Institutional Controls would require minimum clearing for installation of warning signs and display boards, and should not measurably impact sensitive biological resources. The removal action alternatives (Alternatives 3, 4, and 5) entail brush thinning, which would have a significant impact on wildlife in the area. Brush thinning may temporarily reduce the mass of coastal sage scrub, which provides valuable habitat for the California gnatcatcher, a federal threatened and California species of special concern. The coastal sage scrub habitat is one of the rarest and most endangered habitats in California. Surface and Subsurface Clearance to a Depth of 1 Foot and Construction Support also require excavations and would have the biggest impact on the endangered and threatened species. However, as in Sector 1, consultation with a biologist prior to and during clearance activities would help to minimize adverse ecological impacts of the removal action.

5.2.1.0.3 Long-Term Effectiveness. No Action and Institutional Controls do not remove UXO and would limit the land use in the long term, so UXO would continue to pose a threat to human health and safety. Surface Clearance, Surface and Subsurface Clearance to a Depth of 1 Foot, and Construction Support would remove UXO from the site and thus reduce long-term threats associated with UXO and facilitate better use of the land. Because Surface and Subsurface Clearance to a Depth of 1 Foot and Construction Support would also facilitate removal of UXO from the subsurface, these alternatives would allow activities that may cause subsurface intrusion such as landfill construction. However, risks to recreational users would remain for 20 to 30 years, so Construction Support offers less long-term effectiveness than do the other removal action alternatives.

5.2.1.0.4 Short-Term Effectiveness. Institutional Controls can be implemented relatively quickly, so the associated risk reduction could be achieved within a few months. Conversely, Surface Clearance (Alternative 3) and Surface and Subsurface Clearance to a Depth of 1 Foot (Alternative 4) would most likely require five years or more to complete. Because Construction Support is implemented in conjunction with the landfill expansion, completion of the removal action within the entire sector would likely require more than 20 years. Therefore, Construction Support has no short-term effectiveness.

5.2.2 Implementability

5.2.2.0.1 Technical Feasibility. From a technical perspective, all alternatives are feasible. The technology to construct the warning signs and display boards is readily available and reliable, as is the geophysical equipment for detection of OE at the site. All alternatives have been successfully implemented at other areas of the former Camp Elliott (i.e., Tierrasanta and Mission Trails) in the past. Construction Support was recently provided to the Sycamore Landfill in East Elliott.

5.2.2.0.2 Administrative Feasibility. No permits are likely to be associated with implementation of Institutional Controls, nor are extensive subcontractor services, such as

security, that would require oversight and coordination. However, easements or other agreements with property owners may be required. Institutional Controls would also require indefinite maintenance. Permits may be required for the removal action alternatives (Alternatives 3, 4, and 5) during UXO detonation, but are not expected to be extensive. The removal action alternatives would also take longer to implement than Institutional Controls, and would require project oversight and support for an extended duration. This is particularly true for Construction Support.

5.2.2.0.3 **Availability of Services and Materials.** All services and materials required to implement the alternatives are readily and commercially available.

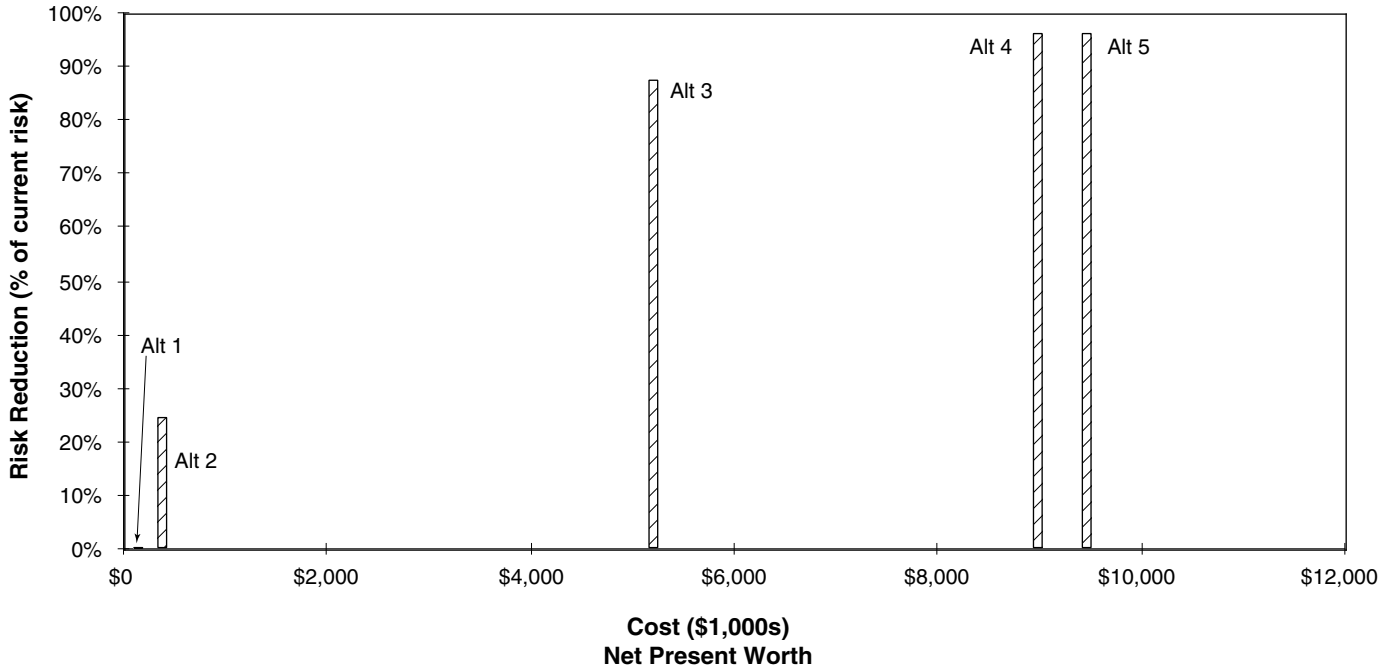
5.2.3 Cost

5.2.3.0.1 As described in Section 4.0, estimated costs of the alternatives are based on a 30-year present worth analysis of estimated direct initial costs, indirect initial costs, and recurring costs. There is uncertainty associated with the number of magnetic anomalies within the sector and whether the anomalies require remediation, so a large project contingency (25 percent of initial and recurring costs) is included in the cost estimates. Itemized costs for each alternative retained for Sector 2 are in Appendices D (Alternative 2) and E (Alternatives 3, 4, and 5).

5.2.3.0.2 The alternatives can be ranked by increasing cost as follows: No Action, Institutional Controls, Surface Clearance, Construction Support, and Surface and Subsurface Clearance to a Depth of 1 Foot. Conversely, no costs would be incurred with No Action.

5.2.4 Cost-Benefit Analysis

5.2.4.0.1 Because each removal action alternative is generally implementable to varying degrees, the critical criteria for comparing the alternatives are effectiveness and cost. Figure 5-2 illustrates the relationship between cost and effectiveness, or relative risk reduction. From the graph it is apparent that, in general, as protection increases, greater financial costs are incurred.



Alt 1 – No Action
Alt 2 – Institutional Controls
Alt 3 – Surface Clearance
Alt 4 – Surface and Subsurface Clearance to a Depth of 1 Foot
Alt 5 – Construction Support

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FORMER CAMP ELLIOTT (EAST ELLIOTT)
COST-EFFECTIVENESS GRAPH FOR SECTOR 2

FIGURE 5-2

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5.2.4.0.2 Figure 5-2 suggests that a significant risk reduction occurs between Institutional Controls and Surface Clearance. Additionally, Surface and Subsurface Clearance to a Depth of 1 Foot and Construction Support do not significantly reduce risk over Surface Clearance, even though substantial additional costs are associated with these alternatives.

5.2.4.0.3 Sycamore Landfill in Sector 2 currently plans to expand. The current landfill encompasses approximately 170 acres, and the total area to be covered by the landfill is approximately 500 acres. Removal actions at Sector 2 could be implemented in conjunction with the landfill construction. However, implementation of Surface Clearance before construction would significantly reduce immediate current risks to recreational users. Therefore, Surface Clearance is the most cost-effective removal action at this time. This alternative would substantially reduce risks to both recreational users and construction workers. Note that subsurface clearance has already been provided as construction support during the recent expansion of the landfill. In addition, approximately 65 acres of Sector 2 north and south of the landfill were cleared of surface OE during the recent Time-Critical Removal Action.

5.2.4.0.4 Implementation of Surface and Subsurface Clearance to a Depth of 1 Foot or Construction Support would yield minimal (approximately 12 percent) risk reduction with a substantial increase in costs (more than $5 million). The additional cost is not justified when compared to risk reduction, making Surface and Subsurface Clearance to a Depth of 1 Foot and Construction Support economically prohibitive. However, especially for the area to be excavated, clearance of UXO encountered in the subsurface may still be required during landfill construction. These services could be performed under periodic monitoring on an as-needed basis (i.e., in the event subsurface OE is encountered).

5.3 ALTERNATIVES EVALUATION FOR SECTOR 3

5.3.0.0.1 Sector 3 is approximately 750 acres in the southwest quadrant of East Elliott. This sector is bounded by Oak Canyon to the west, Little Sycamore Canyon to the east, and State

Highway 52 to the south. Topography is primarily steep-walled canyons and narrow ridges in the northern part of the sector with less steep slopes in the southern area. Vegetation is mixed chaparral, dense brush, and poison oak in the north, and grasslands in the south.

5.3.0.0.2 As suggested by SiteStats/GridStats and OECert analyses, the current risk levels are considered to be very low because UXO was not found in Sector 3 during the site investigation. Only No Action (Alternative 1) and Institutional Controls (Alternative 2), which consist of warning signs and display boards, were retained for Sector 3.

5.3.1 Effectiveness

5.3.1.0.1 Overall Protection of Human Health and the Environment. As indicated by the OECert analysis, the current risk levels at Sector 3 are within the acceptable range because no UXO was found during the 1996 site investigation (see Section 2.3). Therefore, according to the risk assessment (Appendix C), there are no OE exposures anticipated for current or future land uses. Consequently, no removal action is warranted for Sector 3. However, even though UXO was not found within Sector 3, inert OE fragments were present within the area and there is a slight possibility that UXO may be present in Sector 3. Direct contact with unanticipated UXO in Sector 3 could be lethal. The No Action alternative does not restrict physical contact with UXO that may be present in the sector and therefore does not provide any risk reduction in the unlikely event that UXO is encountered in Sector 3. In contrast, Institutional Controls would raise public awareness about the possibility of UXO in the area and thereby reduce the chances of the public disturbing any UXO.

5.3.1.0.2 Compliance with ARARs. The No Action alternative would have no impact on the wildlife in the area. Institutional Controls would require minimal brush pruning in a limited number of locations within the sector and should not result in measurable impact on sensitive biological resources in the area.

5.3.1.0.3 Long-Term Effectiveness. No Action does not remove UXO from the area and therefore does not exhibit any long-term effectiveness. Institutional Controls may increase the public awareness as to the presence of UXO in the area, but does not remove UXO from the sector. Residual UXO, if present, would continue to pose a long-term threat to human health and the environment.

5.3.1.0.4 Short-Term Effectiveness. The selected alternatives can be implemented in a few months without any significant adverse impacts to the environment. Hence, both alternatives exhibit a high degree of short-term effectiveness.

5.3.2 Implementability

5.3.2.0.1 Technical Feasibility. From a technical perspective, both alternatives are feasible. The technology to construct the warning signs and display boards is readily available and reliable.

5.3.2.0.2 Administrative Feasibility. No permits are likely to be required for implementation of Institutional Controls nor are extensive subcontractor services, such as security, that would require oversight and coordination. However, easements or other agreements with property owners may be required. An Institutional Control Plan that outlines the authorities and inter-agency agreements would be prepared prior to implementation of this alternative.

5.3.2.0.3 Availability of Services and Materials. All services and materials required to implement the alternatives are readily and commercially available. Similar signs and displays have been installed at Tierrasanta and Mission Trails Regional Park.

5.3.3 Cost

5.3.3.0.1 Because only Institutional Controls and No Action were retained for Sector 3, a detailed cost comparison is not necessary for this sector. Institutional Controls would incur greater initial and recurring costs, and would cost more overall to implement than the No Action alternative. Itemized costs to implement the remedial alternatives at Sector 3 are in Section 4.4 and Appendix D (Table D-8).

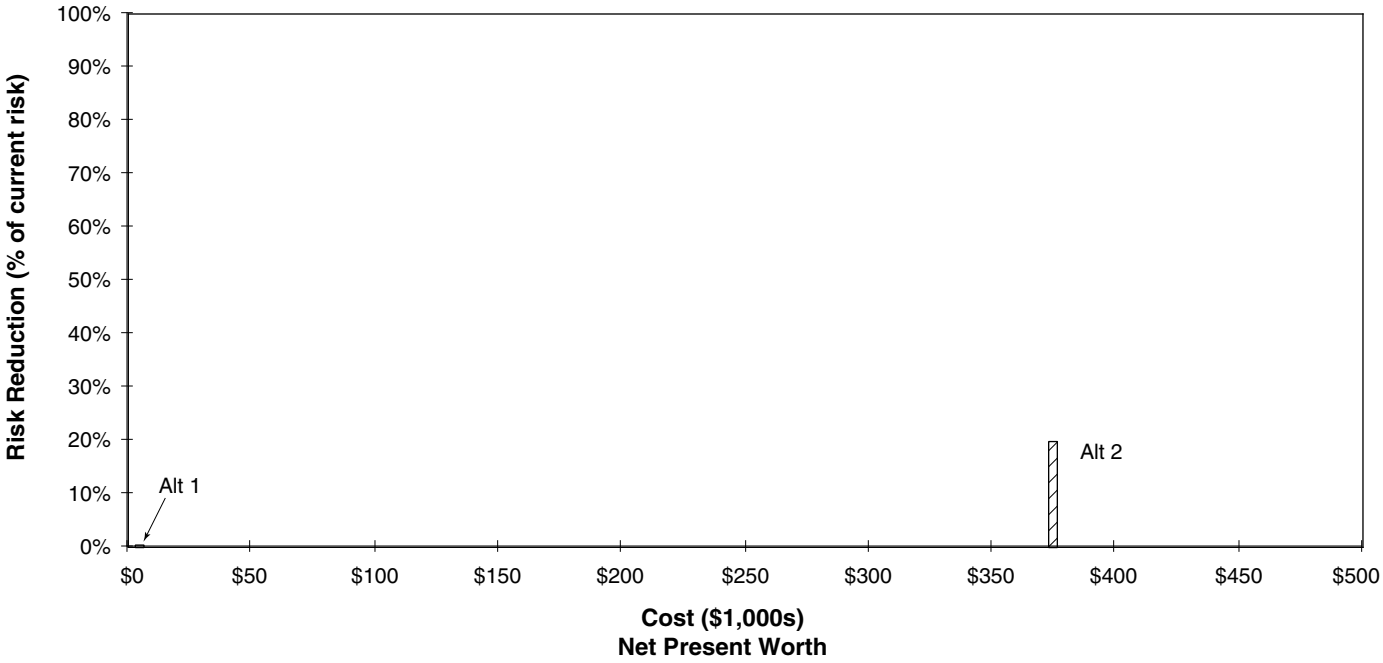
5.3.4 Cost-Benefit Analysis

5.3.4.0.1 Although the current risk levels at Sector 3 are very low due to limitations of OE detection and sampling equipment and techniques, it is possible that UXO may exist at Sector 3. To minimize dangers to public safety associated with UXO, implementation of minimum control measures is recommended at Sector 3. Costs associated with implementing Institutional Controls are approximately one to two orders of magnitude less than the clearance alternatives. Hence, Alternative 2 should be selected because it provides a cost-effective degree of protection in the unlikely event that UXO is encountered in Sector 3 (Figure 5-3).

5.4 ALTERNATIVES EVALUATION FOR SECTOR 4

5.4.0.0.1 Sector 4 is approximately 1,050 acres in the eastern portion of East Elliott, including the area that is most frequently used for recreational activities. The sector is bounded by Sycamore Canyon to the east, the county landfill and Little Sycamore Canyon to the west, and the City of Santee to the south. The terrain is defined by three primary ridges and moderate slopes. Mast Boulevard and West Hills High School are in the southeast corner of the sector. Vegetation is grasslands and mixed chaparral, with local areas of heavy brush.

5.4.0.0.2 All of the clearance alternatives except Construction Support (Alternative 5) were retained for Sector 4. The Institutional Controls alternative was also retained because these technologies may modify the behavior of people who encounter UXO for an overall reduction of



Alt 1 – No Action
Alt 2 – Institutional Controls

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FORMER CAMP ELLIOTT (EAST ELLIOTT)
COST-EFFECTIVENESS GRAPH FOR SECTOR 3

FIGURE 5-3

08-99.CE

the hazard associated with the presence of UXO. In addition, the No Action alternative was retained for baseline comparison. Thus, this comparative analysis includes the following alternatives:

- Alternative 1: No Action
- Alternative 2: Institutional Controls (Warning Signs, Display Boards, and Public Awareness Training)
- Alternative 3: Surface Clearance
- Alternative 4: Surface and Subsurface Clearance to a Depth of 1 Foot

5.4.0.0.3 The following evaluation of alternatives for Sector 4 assumes a baseline for comparison of No Action. However, due to the immediate risk to recreational users at the site, a Time-Critical Removal Action was performed from July 1998 to February 1999. During this project, OE was removed from the ground surface on trails, roads, and open areas within approximately 900 acres of Sector 4. OE was not removed from areas of heavy brush (Section 2.4.2).

5.4.1 Effectiveness

5.4.1.0.1 Protection of Human Safety and Health and the Environment. The primary basis for evaluating this criterion is the net reduction in UXO provided by each alternative. As suggested in the risk analysis, a direct relationship exists between the quantity of UXO and potential for exposure to UXO. The No Action alternative does not reduce the amount of UXO, nor does it reduce the number of anticipated exposures to UXO, so this alternative is not protective of human health and the environment. Because fencing is not a viable option for Sector 4, Institutional Controls would not reduce the potential for exposure through access restriction. However, Institutional Controls would raise the public awareness about the possibility of UXO in the area. As discussed in Section 4.0, public awareness programs, including warning signs and display boards, have a net positive effect in reducing the exposure potential. Surface Clearance and Surface and Subsurface Clearance to a Depth of 1 Foot would

provide for removal of UXO from the surface where the majority of the OE (72 percent) was encountered (Section 4.0). Surface and Subsurface Clearance to a Depth of 1 Foot would provide an additional risk reduction of 4 percent by removing UXO from subsurface soils.

5.4.1.0.2 Compliance with ARARs. Probably the most crucial ARAR associated with a removal action implementation at East Elliott is the impact to sensitive biological resources within the sector. The No Action alternative would have the least impact with regard to threatened and endangered species. Institutional Controls would require minimum clearing for installation of warning signs and display boards and should not measurably impact sensitive biological resources. Surface Clearance would entail brush pruning and would have a significant impact on the wildlife. Brush pruning may temporarily reduce the mass of coastal sage scrub, which provides valuable habitat for the California gnatcatcher, a federal threatened and California species of special concern. The coastal sage scrub is one of the rarest and most endangered habitats in California. Surface and Subsurface Clearance to a Depth of 1 Foot would require excavation in addition to the potential destruction to vegetation, and would have the biggest impact on the endangered and threatened species. However, as in Sectors 1 and 2, adverse ecological impacts could be minimized by consulting a biologist prior to and during implementation of the removal action, and scheduling removal operations around the nesting season.

5.4.1.0.3 Long-Term Effectiveness. No Action and Institutional Controls do not remove UXO and would limit the land use in the long term. UXO in the area would continue to threaten human health and safety. Surface Clearance and Surface and Subsurface Clearance to a Depth of 1 Foot would permanently remove UXO from the surface and thus facilitate better use of the land. Surface Clearance would also reduce any long-term risks associated with UXO. Because Surface and Subsurface Clearance to a Depth of 1 Foot would also facilitate removal of UXO from the subsurface, these alternatives would allow activities, such as residential development, that may cause subsurface intrusion.

5.4.1.0.4 Short-Term Effectiveness. Institutional Controls can be implemented relatively quickly, and the risk reduction could be achieved within a few months. Conversely, the removal action alternatives could require two years or more to complete. Therefore, the removal action alternatives have little short-term effectiveness.

5.4.2 Implementability

5.4.2.0.1 Technical Feasibility. From a technical perspective, all alternatives are considered feasible. The technology to construct the warning signs and display boards is readily available and reliable, as is the geophysical equipment for detection of OE at the site. All alternatives have been successfully implemented at other areas of the former Camp Elliott (i.e., Tierrasanta and Mission Trails) in the past. OE has already been removed from the ground surface in most areas of Sector 4 during the Time-Critical Removal Action (Section 2.4.2).

5.4.2.0.2 Administrative Feasibility. No permits are likely to be required for implementation of Institutional Controls, nor extensive subcontractor services such as security, which would require oversight and coordination. However, easements or other access agreements with property owners may be required. Permitting requirements may be associated with Surface Clearance and Surface and Subsurface Clearance to a Depth of 1 Foot during UXO detonation, but are not expected to be extensive. These clearance alternatives would take longer to implement than Institutional Controls, and would require project oversight for an extended duration.

5.4.2.0.3 Availability of Services and Materials. All services and materials required to implement the alternatives are readily and commercially available.

5.4.3 Cost

5.4.3.0.1 As described in Section 4.0, estimated costs for the alternatives are based on a 30-year present worth analysis of estimated direct initial costs, indirect initial costs, and recurring

costs. Uncertainty is associated with the number of magnetic/geophysical anomalies within the sector and whether the anomalies require remediation, so a large project contingency (25 percent of initial and recurring costs) is included in the cost estimates. Itemized costs for each alternative retained for Sector 4 are presented in Appendices D (Alternative 2) and E (Alternatives 3, 4, and 5).

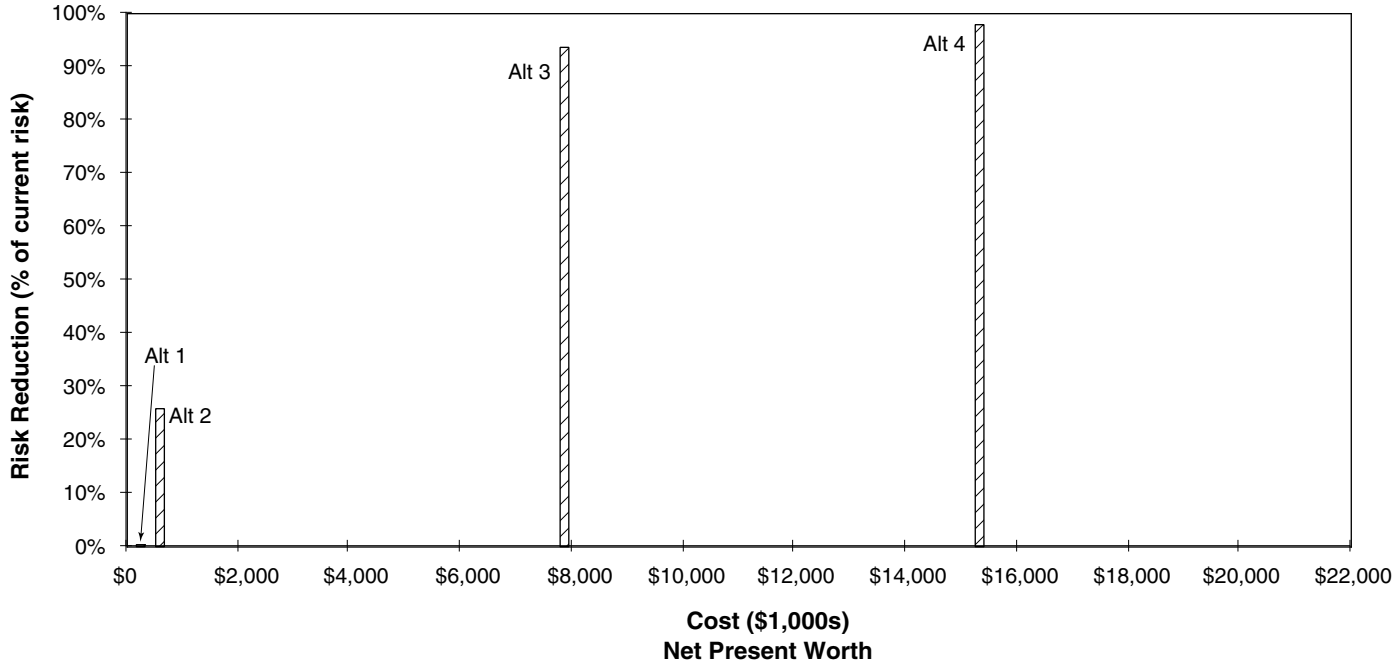
5.4.3.0.2 The removal action alternatives can be ranked by increasing cost as follows: No Action, Institutional Controls, Surface Clearance, and Surface and Subsurface Clearance to a Depth of 1 Foot. No costs would be incurred with No Action alternative.

5.4.4 Cost-Benefit Analysis

5.4.4.0.1 Because each removal action alternative is generally implementable to varying degrees, the most critical criteria for comparing the alternatives are effectiveness and cost. Figure 5-4 shows the relationship between cost and effectiveness, or relative risk reduction, with a cost-effectiveness curve. The graph shows that, in general, as increased protection is gained, greater financial costs are incurred.

5.4.4.0.2 Figure 5-4 suggests that a significant risk reduction occurs between Institutional Controls and Surface Clearance. Subsurface OE removal does not appear to add significantly to risk reduction (i.e., 4 percent). However, recent observation of recreational activities (such as children digging in play areas) indicate that risks from subsurface OE in Sector 4, which are at least five times greater than those in other sectors, may be underestimated. In addition, many magnetic anomalies that may indicate the presence of subsurface OE were observed during the Time-Critical Removal Action (Sector 2.4.2). Based on these factors, selection of Surface and Subsurface Clearance to a Depth of 1 Foot (Alternative 4) is warranted, even though it is substantially more costly.

5.4.4.0.3 Because the Time-Critical Removal Action included the Surface Clearance of approximately 900 acres of Sector 4, the non-time-critical removal action in Sector 4 would



Alt 1 – No Action
Alt 2 – Institutional Controls
Alt 3 – Surface Clearance
Alt 4 – Surface and Subsurface Clearance to a Depth of 1 Foot

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FORMER CAMP ELLIOTT (EAST ELLIOTT)
COST-EFFECTIVENESS GRAPH FOR SECTOR 4

FIGURE 5-4

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include Surface Clearance of the remaining areas. Because no OE, including scrap, was discovered in the 300 acres north and east of Quail Canyon, a reduction in the scope of the proposed overall removal action is also recommended to eliminate additional clearance of OE in this area. Therefore, the remaining removal action includes surface removal of OE in areas of heavy brush not included in the Time-Critical Removal Action, and subsurface removal of OE within the approximately 750-acre area south and west of Quail Canyon.